

1           **Claims**

1           1.   A method of controlling a biological wastewater treatment  
2           process, comprising:

3           A.   in at least one treatment tank containing wastewater, conducting  
4           a biological process supported, at least in part, by introducing oxygen-  
5           containing gas into the wastewater in the form of bubbles provided in the  
6           wastewater by a gas supply system, and causing at least a portion of the  
7           oxygen in said bubbles to dissolve in the wastewater and at least a portion  
8           of the dissolved oxygen to be consumed by the biological process

9           1.   wherein the oxygen so dissolved may represent an excess or a  
10          deficiency relative to the oxygen consumed by the biological process, and

11          2.   wherein at least one gas collection member is positioned in the  
12          treatment tank to receive offgas representing gas from said bubbles that  
13          has not been dissolveed into the wastewater;

14          B.   controlling the operation of the biological process with a control  
15          system that, as the process operates, exercises continuing control over the  
16          process at least partially in response to measurements, that are taken by  
17          the control system from the offgas collected in the gas collection member  
18          and that are correlative with the amount of one or more gases in the offgas;  
19          and

1 C, utilizing data obtained through said measurements to provide, in  
2 the control system, for the varying amounts of consumption of oxygen that  
3 occur in the biological process, control values, or components of control  
4 values, that change in response to, while remaining correlative with, such  
5 varying amounts of oxygen consumption, and generating control signals  
6 based on the changing control values or components.

1 2. A method of controlling a wastewater treatment process,  
2 comprising:

3 A. in at least one treatment tank containing wastewater, conducting  
4 a biological process comprising suspended growth aeration in which  
5 biological breakdown of suspended and/or dissolved waste material present  
6 in the wastewater is supported, at least in part, by introducing oxygen-  
7 containing gas into the wastewater in the form of bubbles provided in the  
8 wastewater by a gas supply system, which bubbles rise through at least a  
9 portion of the depth of the wastewater in the direction of its upper surface,  
10 and causing at least a portion of the oxygen in said bubbles to dissolve in  
11 the wastewater and at least a portion of the dissolved oxygen to be  
12 consumed by the biological process

13 1. wherein the oxygen so dissolved may comprise an excess or  
14 represent a deficiency relative to the oxygen consumed by the biological  
15 process, and

16           2.   wherein at least one gas collection member is positioned to  
17   receive offgas representing gas from said bubbles that has not been  
18   dissolved into the wastewater;

19           B.   controlling the operation of the process with a control system  
20   that, as the process operates, exercises continuing control over the  
21   introduction of wastewater into the process and/or over the quantity of gas  
22   discharged into the tank through said gas supply system, at least partially in  
23   response to measurements of the offgas, taken by the control system, that  
24   are correlative with the amount of one or more gases in the offgas; and

25           C.   utilizing data obtained through said measurements to provide, in  
26   the control system, control values which are at least in part correlative with  
27   changing needs for the supply of dissolved oxygen to the wastewater as  
28   determined by the control system at least partly on the basis of such data.

1           3.   Control system apparatus for controlling a biological wastewater  
2   treatment process, comprising:

3           A.   at least one gas collection member, positioned in at least one  
4   wastewater processing tank in which the biological process is conducted, to  
5   collect from the wastewater in the processing tank, offgas representing at  
6   least a portion of oxygen-containing gas that has been introduced into but  
7   not dissolved in the wastewater,

8           B.   at least one measuring device comprising at least one gas  
9   detector that is connected with the gas collection member and that can take  
10   measurements and thereby provide data indicative of the amount of at least  
11   one gas in the offgas collected by the gas collection member, and  
12

13           C.   at least one controller which is connected with the measuring  
14   device, which defines, for the varying amounts of consumption of oxygen  
15   that occur in the biological process, control values, or components of  
16   control values, that change in response to, while remaining correlative with,  
17   such varying amounts of oxygen consumption, which controller generates  
18   control signals based on the control values or components.

1           4.   A control system for controlling wastewater treatment apparatus  
2   of the type that comprises at least one tank for conducting a biological  
3   process comprising suspended growth aeration on wastewater, a gas  
4   supply system for introducing oxygen-containing gas into the wastewater in  
5   the form of bubbles and causing at least a portion of the oxygen in said  
6   bubbles to dissolve in the wastewater and at least a portion of the dissolved  
7   oxygen to be consumed by the biological process, wherein the oxygen so  
8   dissolved may comprise an excess or represent a deficiency relative to the  
9   oxygen consumed by the biological process, and wherein at least one gas  
10   collection member is positioned to receive offgas representing gas from  
11   bubbles that have not been not dissolveed into the wastewater; said control  
12   system comprising:

13           A.   at least one gas detector that can take measurements of the  
14   amount of at least one gas collected in the gas collection member,

15           B.   at least one DO (dissolved oxygen) detector having a probe  
16   that, when in contact with the wastewater in the tank, can take  
17   measurements of the DO level of the wastewater, and

18           C.   at least one controller containing or having access to code  
19   which the controller can utilize with said measurements to provide, in the  
20   control system, control values which are at least in part correlative with  
21   changing needs for the supply of dissolved oxygen to the wastewater.